CLAIMS

Subs A2

1. Method of transmitting data on multiple carriers from a transmitter to a receiver, the said method consisting, on the transmitter side, of binary to signal coding of the data to be transmitted so as to form modulation signals, of modulating a plurality of sub-carriers with the said modulation signals so as to form symbols, referred to as OFDM symbols, and then of transmitting, over the said channel between the said transmitter and the said receiver, the said OFDM symbols at a rate which is related to a sampling frequency referred to as the transmitter sampling frequency, and, on the receiver side, of determining, from a clock signal at a frequency related to a sampling frequency referred to as the receiver sampling frequency, an analysis window for the signal received from the transmitter so as to form a block of samples, and of estimating the said transmitted modulation signals by demodulating the said sub-carriers for the said block of samples under consideration, characterised in that the said estimation step is designed to correct the changes in the position of the analysis window with respect to the said transmitted signal.

2. Data transmission method according to Claim 1, characterised in that the said estimation step consists of demodulating the said sub-carriers for the said block of samples under consideration and then correcting the effects of the transmission channel between the transmitter and the receiver, the said step of correcting the changes in the position of the analysis window consisting of estimating the phase difference between two consecutive symbols and using this phase difference during the said correction of the effects of the transmission channel between the transmitter and the receiver.

3. Data transmission method according to Claim 2, characterised in that, for estimating the phase difference between two consecutive symbols, it consists of estimating the degree of shift of the sampling frequency of the receiver with respect to that of the transmitter,

$$\delta = \delta f_e / f_e^E = (f_e^R - f_e^E) / f_e^E$$

the said phase difference between two consecutive symbols then being equal to:

$$\beta_{k,n} = 2\ \pi\, k\, \delta\, T_s / T_u$$

where T_s is the total length of the symbol under consideration, T_u its useful part, k being the index of the carrier under consideration and n being the index of the OFDM symbol under consideration.

4. Data transmission method according to Claim 2, characterised in that, for estimating the phase difference between two consecutive symbols, it consists of taking into account the shift decision for the position of the said analysis window delivered by a window repositioning unit, the said phase difference between two consecutive symbols then being equal to:

$$\beta_{k,n} = 2\ \pi\, k\, \alpha.T/T_u$$

where T is the duration of a sample and α the shift decision value expressed as a number of samples.

5. Data transmission method according to Claim 3, characterised in that, for estimating the phase difference between two consecutive symbols, it consists of taking into account the shift decision for the position of the said analysis window delivered by a window repositioning unit, the said phase difference between two consecutive symbols then being equal to:

$$\beta_{k,n} = 2\ \pi\, k\, (\delta\, T_s + \alpha.T)/T_u$$

where T is the duration of a sample and α the shift decision value expressed as a number of samples.

6. Data transmission method according to one of the preceding claims, characterised in that it consists of estimating the response of the

channel for one or more reference symbols transmitted at the same time as the said transmitted symbols and of applying the said phase difference between consecutive symbols to the said transmission channel estimation by means of the following recursive equation:

$$\widetilde{H}_{k,n} = \widetilde{H}_{k,n-1} e^{j\beta'_{k,n}}$$

where $\widetilde{H}_{k,n} = \widetilde{H}_{k,n-1} e^{j\beta'_{k,n}}$ represents the estimation of the channel response for the carrier of index k and for the OFDM symbol of index n, $\beta'_{k,n}$ being the estimation of the phase difference between the consecutive OFDM symbols of respective indices $n - 1$ and n for the carrier of index k.

7. Data transmission method according to one of Claims 1 to 5, characterised in that it consists of estimating the response of the transmission channel for one or more distributed pilots transmitted at the same time as the said transmitted symbols, of interpolating, time-wise and frequency-wise, the frequency response of the channel at all frequencies and for all symbols and of applying the said phase difference between consecutive symbols to the said transmission. channel estimation.

8. Data transmission method according to one of Claims 1 to 5, according to which the binary to signal coding is of the differential type, characterised in that it consists of shifting the phase, by the said phase difference between consecutive OFDM symbols, of the result of the differential demodulation for the carrier of index k of the nth OFDM symbol.

9. Receiver in a system for transmitting data on multiple carriers, of the type designed to receive signals transmitted by a transmitter, the said transmitter being designed for binary to signal coding of the data to be transmitted so as to form modulation signals, for modulating a plurality of sub-carriers with the said modulation signals so as to form symbols, referred to as OFDM symbols, and then for transmitting the said OFDM symbols at a rate which is related to a sampling frequency referred to as the transmitter

sampling frequency, the said receiver being designed to determine, from a clock signal at a frequency related to a sampling frequency referred to as the receiver sampling frequency, an analysis window for the signal received from the transmitter so as to form a block of samples and, to estimate the said transmitted modulation signals by demodulating the said sub-carriers for the said block of samples under consideration, characterised in that the said receiver is designed to correct the changes in the position of the analysis window with respect to the said transmitted signal.

10. Receiver according to Claim 9, characterised in that, for estimating the said transmitted modulation signals, it has means for demodulating the said sub-carriers for the said block of samples under consideration and means for correcting the effects of the transmission channel between the transmitter and the receiver, and in that, for correcting the changes in the position of the analysis window, it has means for estimating the phase difference between two consecutive symbols, the said phase difference then being used by the means for correcting the effects of the transmission channel between the transmitter and the receiver.

11. Receiver according to Claim 10, characterised in that, for estimating the phase difference between two consecutive symbols, the said receiver is designed to estimate the degree of shift of the sampling frequency of the receiver with respect to that of the transmitter,

$$\delta = \delta f_e / f_e^E = (f_e^R - f_e^E) / f_e^E$$

the said phase difference between two consecutive symbols then being equal to:

$$\beta_{k,n} = 2\,\pi\, k\, \delta\, T_s / T_u$$

where T_s is the total length of the symbol under consideration, T_u its useful part, k being the index of the carrier under consideration and n being the index of the OFDM symbol under consideration.

12. Receiver according to Claim 10, characterised in that, for estimating the phase difference between two consecutive symbols, it is designed to take into account the shift decision for the position of the said analysis window delivered by a window repositioning unit, the said phase difference between two consecutive symbols then being equal to:

$$\beta_{k,n} = 2\,\pi\, k\,(\alpha T)/\,T_u$$

where T is the duration of a sample and α the shift decision value expressed as a number of samples.

13. Receiver according to Claim 11, characterised in that, for estimating the phase difference between two consecutive symbols, it is designed to take into account the shift decision for the position of the said analysis window delivered by a window repositioning unit, the said phase difference between two consecutive symbols then being equal to:

$$\beta_{k,n} = 2\,\pi\, k\,(\delta\, T_s + \alpha T)/\,T_u$$

where T is the duration of a sample and α the shift decision value expressed as a number of samples.

14. Receiver according to one of Claims 9 to 13, characterised in that it is designed to estimate the response of the channel for one or more reference symbols transmitted, by the said transmitter, at the same time as the said transmitted symbols and to apply the said phase difference between consecutive symbols to the said transmission channel estimation by means of the following recursive equation:

$$\widetilde{H}_{k,n} = \widetilde{H}_{k,n-1} e^{j\beta_{k,n}}$$

where $\widetilde{H}_{k,n} = \widetilde{H}_{k,n-1} e^{j\beta_{k,n}}$ represents the estimation of the channel response for the carrier of index k and for the OFDM symbol of index n,

$\beta'_{k,n}$ being the estimation of the phase difference between the consecutive OFDM symbols of respective indices $n - 1$ and n for the carrier of index k.

15. Receiver according to one of Claims 9 to 13, characterised in that it is designed to estimate the response of the transmission channel for one or more distributed pilots transmitted at the same time as the said transmitted symbols, to interpolate, time-wise and frequency-wise, the frequency response of the channel at all frequencies and for all symbols and to apply the said phase difference between consecutive symbols to the said transmission channel estimation.

16. Receiver according to one of Claims 9 to 13, the said binary to signal coding performed by the said transmitter being of the differential type, characterised in that it is designed to shift the phase, by the said phase difference between consecutive OFDM symbols, of the result of the differential demodulation for the carrier of index k of the nth OFDM symbol.

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